

# EXHIBIT A

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81208-246275

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of: )  
NIELSEN, HENRIK K. ET AL. )  
Serial No: 09/195,533 )  
Filed: November 18, 1998 )  
For: DETECTION SYSTEM FOR )  
NANOMETER SCALE TOPOGRAPHIC )  
MEASUREMENTS OF REFLECTIVE )  
SURFACES )

) Art Unit: 2877  
) Examiner: R. ROSENBERGER

AMENDMENT ACCOMPANYING REQUEST FOR CONTINUED EXAMINATION  
(RCE) APPLICATION

Assistant Commissioner for Patents  
Washington, D.C. 20231

Dear Sir:

In response to the Office Action dated February 28, 2001 in connection with the above-identified application, please enter and consider the following amendment and remarks.

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IN THE SPECIFICATION:

On page 8, line 23, please delete the paragraph beginning with "The optics" and insert the following paragraph:

--The optics arrangement 107 includes first lens 111, mask 112, second lens 113, third lens 114, and fourth and fifth lens combination 115, comprising fourth lens 115a and fifth lens 115b. These lenses in the optics arrangement 107 shape and focus the light beams to fix at a desired spot size on the surface of the wafer 110. Dark Field Collection arrangement 116 is used in conjunction with Dark Field Narrow and Dark Field Wide channels.--

IN THE CLAIMS:

Please amend claims 1 and 37 as follows:

1. (Thrice amended) A system for inspecting a specimen, comprising:  
an optical element arrangement for receiving light from a light generating device and imparting light toward said specimen and receiving a retro beam from said specimen;  
a retro beam diversion element for diverting the retro beam from said optical element arrangement;  
a multi-element sensing device for receiving and sensing retro beam position upon diversion from said optical arrangement, said multi-element sensing device comprising a plurality of linearly oriented sensing elements such that said retro beam is received by at least three of said sensing elements; and  
a plurality of weighting elements corresponding to each of said plurality of sensing elements, wherein each of said weighting elements alters a characteristic of an electrical output of said corresponding sensing element based on a distance of said sensing element from a

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predetermined point on said multi-element sensing device.

37. (Thrice amended) A method for inspecting a specimen, comprising:  
providing light energy to said specimen via an arrangement of optical elements, thereby creating a retro beam reflected from said specimen;  
passing said retro beam back through said arrangement of optical elements;  
providing said retro beam to a multi-element sensing device, said retro beam having an expected deflection in a substantially predetermined direction and said multi-element sensing device comprising a plurality of linearly oriented sensing elements such that said retro beam is received by at least three of said sensing elements, each of said sensing elements producing an electrical output in response to sensing a portion of said retro beam; and  
altering a characteristic of said electrical output according to a weighting element corresponding to a distance of each of said plurality of sensing elements from a predetermined point on said multi-element sensing device,  
wherein said sensing device senses movement of the retro beam corresponding to anomalies on said specimen.

#### REMARKS

Claims 1-17, 24, 26-31, 37-48, 50 and 61-63 are pending. Claims 1 and 37 have been amended. Reexamination and reconsideration of this application are respectfully requested.

The Examiner rejected claims 4, 8-10, 42, 43, 45, and 46 under 35 U.S.C. §112, first paragraph. With respect to claim 4, the Examiner stated that the specification does not clearly disclose a "dark field collection arrangement" as recited in claim 4. The Examiner further stated

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that there was no disclosure relating to any structure that would produce this. Applicants respectfully note that on page 9 of the specification as amended on June 8, 2000, the specification recites (with emphasis added):

After the split beam contacts the specimen surface, the light scattered at a narrow angle to the incident beam from surface defects is collected in the Dark Field Narrow (DFN) channel, while most of the light scattered at larger angles by the surface defects is collected in the Dark Field Wide (DFW) channel. The remainder of the beam is specularly reflected back through the components outlined above. As two beams illuminate the wafer surface, two beams are returned through the elements up to the birefringent prism, which combines the two retro beams into a single beam. The single beam is returned through the remaining elements.

Applicants note that a structure is recited by the above paragraph. More specifically, a structure comprising a **Dark Field Narrow channel** and a **Dark Field Wide channel** is described. Dark field collecting arrangements or devices are well known in the art, and a person skilled in the art would know, based upon the paragraph above, that Applicants utilized and were in possession of a dark field collecting arrangement as part of their invention at the time the patent application was filed. Moreover, element 116, as illustrated in Figs. 1 and 2, depicts a dark field collection arrangement that is well known in the art. A person of ordinary skill in the art would know that the drawing of reference 116 refers to a dark field collection arrangement. Accordingly, the disclosure of application does sufficiently describe the invention so that a person of ordinary skill in the art would know that Applicants were in possession of a dark field collection arrangement at the time of the invention. Therefore, Applicants respectfully request that the Examiner's rejection of claim 4 under 35 U.S.C. §112, first paragraph, be withdrawn.

Claims 8-10, 42, 43, 45 and 46 were rejected under 35 U.S.C. §112, first paragraph. The Examiner stated that the application does not adequately describe the Nomarski DIC detector.

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Claims 8-10, 42, 43, 45, and 46 generally include phrases such as "optical element arrangement comprises a Nomarski Differential Interference Contrast sensor" (claim 8) and the Nomarski DIC sensor "divides light received in a single beam into a plurality of beams" (claim 9). These statements are supported in the specification by birefringent or DIC prism 106, explained in detail at page 10, lines 10-29 of the specification as follows:

The current system provides the ability to perform a deviation measurement using the bright field scanning Nomarski Differential Interference Contrast sensor 106. The bright field scanning Nomarski Differential Interference Contrast sensor 106 splits the beam into two separate beams which are applied to the surface of the specimen 110 as shown in Figs. 1 and 2 and outlined above. The specimen 110 is rotated about a vertical axis and concurrently translated horizontally during a typical scan while the beam remains stationary. As a result of the scanning process, the Nomarski DIC sensor 106 senses occurrences in a predetermined direction, such as in a tangential direction from the center of the specimen, while the optical lever created by the optics senses occurrences in an orthogonal direction to that of the Nomarski DIC sensor 106. While the system may use the Nomarski DIC sensor 106 to measure in the tangential direction and the optical lever to measure in the radial direction, it is to be understood that other orientations are possible but it is preferred that the Nomarski DIC sensor and optical lever are always orthogonal to one another.

In his rejection, the Examiner discusses uncertainty regarding the function of beamsplitter 105. As discussed in the specification and from an examination of Figs. 1 and 2, the beamsplitters 105 and 118 are included in the system and either split the retro beam and apply the retro beam to the array 117 or simply allow the retro beam to pass through. In Fig. 1, as shown therein and discussed in the specification, the beamsplitter 105 allows the retro beam to pass "through" and thus does not divert or otherwise alter the retro beam (see, e.g., Specification, page 8, line 29 – page 9, line 1). However, in Fig. 2, the beamsplitter 105 redirects and applies the beam to the array 117.

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Applicants respectfully submit that Figs. 1 and 2, including Nomarski DIC sensor 106, and the beamsplitter 105 in combination with the wording of the specification provide support for the limitations included in claims 8-10, 42, 43, 45, and 46. Therefore, Applicants respectfully request that the Examiner's rejection of claims 8-10, 42, 43, 45 and 46 under 35 U.S.C. §112, first paragraph, be withdrawn. However, should the Examiner still consider the rejection based on the Nomarski DIC prism meritorious based on these sections, Applicants respectfully requests further clarification of the alleged deficiencies in the relevant claim(s).

Claims 1, 6, 11, 13, 16, 17, 37, 41, 44, 47, 62, and 63 were rejected under 35 U.S.C. §103(a) as being obvious over U.S. Patent No. 3,885,875 to Rosenfeld et al. in view of a combination of U.S. Patent No. 5,812,266 to Hercher and further in view of U.S. Patent No. 5,841,127 to Throngnumchai. The Examiner stated that Rosenfeld et al. discloses a light generating device, and optical arrangement for receiving light from a light generating means, and imparting light toward a specimen, a retro beam diversion element, and a position sensor. (February 28, 2001 Office Action, Pages 3-4.) The Examiner further stated that Hercher discloses a system having a position sensitive detector in which a ratio is formed. The Examiner also alleged that Throngnumchai teaches the use of a position-sensing means comprising a multi-element sensing device (D1, D2, D3) with a plurality of weighted elements (the LA's).

Rosenfeld et al. discloses a noncontacting surface profilometer, in which the surface of an object such as a wafer may be measured through the use of a laser. Rosenfeld et al. teaches the use of a two-element sensor (26) to measure light position and light power in a spot of light reflected off of the object. (Col. 5, lines 48-57.) Hercher discloses a non-contact position sensor, in which a light beam is directed at a target object, and the reflected light beam is utilized to determine the position of the object. Throngnumchai is directed toward a position sensor

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comprised of a plurality of photodiodes.

It is respectfully submitted that it would not have been obvious to one skilled in the art to combine the teachings of the Rosenfeld et al., Hercher and Throngnumchai, as suggested by the Examiner. It is well settled that a reference must provide some motivation or reason for one skilled in the art (working without the benefit of Applicants' specification) to make the necessary changes in the disclosed device. A holding of obviousness requires that the motivation for modification of a reference be fairly found within the prior art taken as a whole as represented by the references themselves.

"It is improper to use the claims as a frame, and individual naked parts of separate prior art references as a mosaic, to recreate a facsimile of the claimed invention. To imbue one of ordinary skill in the art with knowledge of the invention in suit, when no prior art reference or references of record convey or suggest that knowledge, is to fall victim to the insidious effect of a hindsight syndrome wherein that which only the invention taught is used against its teacher." *W.L. Gore & Associates, Inc. v. Garlock, Inc.*, 220 U.S.P.Q. 303 (Fed. Cir. 1983); *In re Kamm and Young*, 172 U.S.P.Q. 298 (C.C.P.A. 1972) ("the basic mandate inherent in 35 U.S.C. §103 is that piecemeal reconstruction of prior art patents in the light of Applicant's disclosure shall not be a basis for holding of obviousness"). Further, the mere fact that a reference may be modified in the direction of the claimed invention does not make the modification obvious unless the reference expressly or implicitly teaches or suggests the desirability of the modification. *In re Kotzab*, 55 U.S.P.Q.2d 1313, 1317-18 (Fed. Cir. 2000); *In re Fitch*, 23 U.S.P.Q.2d 1780, 1783 (Fed. Cir. 1992); *In re Mills*, 16 U.S.P.Q.2d 1430, 1432 (Fed. Cir. 1990).

Applicants respectfully submit that it is only with the use of hindsight, after viewing the teachings of the Applicants, that one could construct the claimed invention in view of the teachings

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of Rosenfeld et al.. The use of hindsight is an improper basis for rejecting the claims. Without some showing in the prior art that suggests in some way a combination with another reference in order to arrive at the claimed invention, it is impermissible to use the applicant's teaching to search references for the claimed elements and combine them as claimed. *In Re Vaeck*, 947 F.2d 488 (Fed. Cir. 1991); *In Re Laskowski*, 871 F.2d 115, 117 (Fed. Cir. 1989); *see also, Ex Parte Lange*, 72 U.S.P.Q. 90, 91 (C.C.P.A. 1947) ("It seems to us that the Examiner is using appellant's disclosure for the suggestion of the combination since there is no suggestion in any of the patents for their combination in the manner claimed by Applicant."); *In re Leonor*, 158 U.S.P.Q. 20, 21 (C.C.P.A. 1968) (the issue is "whether teachings of prior art would, of themselves, and without benefit of applicant's disclosure, suggest [a process] which would make claimed invention obvious...") (emphasis in original). Neither the Rosenfeld et al., Hercher or Throngnumachi reference suggest combining the references to produce the unique system claimed in Applicant's claim 1.

Independent claim 1, as amended, is distinguishable over the cited references. Claim 1 specifies: "[a] system for inspecting a specimen, comprising: an optical element arrangement for receiving light from a light generating device and imparting light toward said specimen and receiving a retro beam from said specimen; ... said multi-element sensing device comprising a plurality of linearly oriented sensing elements such that said retro beam is received by *at least three of said sensing elements*". (Emphasis added.)

The inventive concept of the present invention as defined by the language of the claims is the use of a multi-element sensing device comprising a plurality of linearly oriented sensing elements such that the retro beam is received by **at least three** of the sensing elements.

Such a device is much more precise than a sensing device having only two sensing elements. Accordingly, smaller anomalies in the surface of a semiconductor wafer may be detected. Therefore,

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as disclosed in the specification on page 16, lines 17-22, surface height variations on the order of 100 nanometers may be detected. Rosenfeld et al. discloses a position sensor having only **two position-sensing elements (26)**. There is no motivation within Rosenfeld et al. to utilize more than two sensing elements. As shown in Fig. 4 of Rosenfeld et al., light detected by each of the two elements of the sensor (26) is converted into a current and then utilized to measure position and intensity of a light beam.

In order to utilize more than two elements, the circuit in Fig. 4 of Rosenfeld et al. would have to be substantially redesigned. Further, the circuit disclosed in Rosenfeld has components that sum and calculate a difference between the current from each of the two sensor elements. If more than two elements were introduced into the circuit, the circuit would exponentially expand, taking up more space and power, and would become significantly more complex. Again, this is neither suggested nor disclosed in Rosenfeld.

Applicants respectfully submit that the Examiner is reading limitations and advances in the art neither suggested nor disclosed by the cited reference. The Examiner has argued that the teachings of Rosenfeld et al. be combined with the teachings of Hercher. However, Hercher is directed to a significantly different field, namely **monitoring movements of a rotatable read/write head arm in a disk drive servo system**. (Col. 1, lines 11-18.) A person of ordinary skill in the art would not look to disk drive position monitoring art when attempting to measure anomalies on the surface of a specimen, such as a semiconductor wafer. As previously noted, the measurement of surface defects on a specimen such as a semiconductor wafer is extremely precise, and use of monitoring tools from other areas of technology would likely not work in the desired environment. In addition, the Examiner relies on Hercher for its use of a "CD array." Again, there is no motivation to combine in the manner suggested by the reference itself, and the reference cited is

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neither in the field of the inventor's endeavor, nor is it reasonably pertinent to the particular problem with which the inventor was involved. Thus the reference is not analogous art for purposes of analyzing nonobviousness under § 103.

Throngnumchai discloses a position sensor comprised of photodiodes. However, Throngnumchai does not suggest, teach, or disclose using the position sensor to detect surface variations on a semiconductor wafer. A sensor having a function of measuring surface variations on the order of 100 nanometers necessarily must be highly precise. Most sensing devices lack the necessary precision to measure such small variations. There is no suggestion in Throngnumchai to combine the references in the manner suggested by the Examiner; further, there is no teaching, suggestion, or disclosure that the sensor in Throngnumchai has or could have the requisite precision for such an application. Even if a person of ordinary skill did combine the teachings of Throngnumchai with Rosenfeld et al., such an embodiment would not operate in the intended manner as disclosed and claimed by Applicants, because such a construct would lack the requisite precision for semiconductor wafer inspection. Thus Throngnumchai neither includes a motivation to combine nor could its teachings be combined with Rosenfeld to produce the invention disclosed and claimed in the present application.

U.S. Patent No. 5,164,579 to Pryor et al. discloses a position sensor. The teachings of Pryor et al. are directed toward detecting irregularities on a turbine blade of an engine such as a jet engine. (Col. 1, lines 28-33.) Accordingly, a person of ordinary skill in the art would not look to the field of turbine blade inspection to design a semiconductor wafer surface detection system due to the aforementioned lack of precision inherent in such a system. There is also no motivation to combine the systems as suggested by the Examiner.

U.S. Patent No. 5,798,829 to Vaez-Iravani discloses a laser bright field and dark field

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system for detecting anomalies of a sample. Vaez-Iravani discloses the use of a bright field detector (60) and a dark field detector (80). However, Vaez-Iravani does not disclose that either of the detectors is comprised of at least three position sensing elements. Accordingly, the combination of the teachings of Vaez-Iravani and Rosenfeld et al. does not render independent claim 1, as amended, obvious under 35 U.S.C. §103. Further, there is no motivation to combine the references as suggested by the Examiner.

In summary, a person of ordinary skill in the art would not have had the motivation to combine the teachings of Rosenfeld et al., Hercher, and Throngnumchai, as suggested by the Examiner. Moreover, such a person of ordinary skill would also not have combined the teachings of the above-mentioned references with the teachings of Pryor et al. and of Vaez-Iravani. However, even if a person of ordinary skill in the art had combined the teachings of the above-cited references, the resultant combination, even if it could be operated, would lack the requisite precision to detect surface variations on the order of 100 nanometers or less. Accordingly, it is respectfully submitted that one of ordinary skill in the art would have had no motivation to combine the references as suggested by the Examiner. Therefore, it is respectfully submitted that the rejection of independent claim 1, as amended, under 35 U.S.C. §103(a) should be withdrawn.

Claims 6, 11, 13, 16, 17 and 62 all directly depend from independent claim 1, as amended. Accordingly, Applicants respectfully submit that claims 6, 11, 13, 16, 17 and 62 all distinguish over the cited references for the same reasons as set forth above with respect to independent claim 1, as amended. Therefore, it is respectfully submitted that the rejection of claims 6, 11, 13, 16, 17 and 62 under 35 U.S.C. §103(a) should also be withdrawn.

Independent claim 37, as amended, contains limitations similar to those in independent claim 1, as amended. More specifically, independent claim 37, as amended, specifies: "A

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method for inspecting a specimen, comprising: providing light energy to said specimen via an arrangement of optical elements, thereby creating a retro beam reflected from said specimen; providing said retro beam to a multi-element sensing device ... said multi-element sensing device comprising a plurality of linearly oriented sensing elements such that said retro beam is received by at least three of said sensing elements". (Emphasis added.) Applicants respectfully submit that independent claim 37, as amended, distinguishes over the cited references for the same reasons as set forth above with respect to independent claim 1, as amended. Therefore, it is respectfully submitted that the rejection of independent claim 37, as amended, under 35 U.S.C. §103(a) should also be withdrawn.

Claims 41, 44, 47 and 63 all directly depend from independent claim 37, as amended. Accordingly, Applicants respectfully submit that claims 41, 44, 47 and 63 all include limitations distinguishing over the cited references for the same reasons as set forth above with respect to independent claim 37, as amended. Therefore, it is respectfully submitted that the rejection of claims 41, 44, 47 and 63 under 35 U.S.C. §103(a) should also be withdrawn.

Claims 2, 3, 5, 7, 12, 14, 15, and 38-40 were rejected under 35 U.S.C. §103(a) as being obvious over U.S. Patent No. 3,885,875 to Rosenfeld et al. in view of a combination of U.S. Patent No. 5,812,266 to Hercher and further in view of U.S. Patent No. 5,841,127 to Throngnumchai, and further in view of U.S. Patent No. 5,798,829 to Vaez-Iravani. Claims 2, 3, 5, 7, 12, 14 and 15 all depend, directly or indirectly, from independent claim 1, as amended. Accordingly, Applicants respectfully submit that claims 2, 3, 5, 7, 12, 14 and 15 all distinguish over the cited references for the same reasons as set forth above with respect to independent claim 1, as amended.

Claims 38-40 all depend, directly or indirectly, from independent claim 37, as amended.

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Accordingly, Applicants respectfully submit that claims 38-40 all distinguish over the cited references for the same reasons as set forth above with respect to independent claim 37, as amended. Therefore, it is respectfully submitted that the rejection of claims 2, 3, 5, 7, 12, 14, 15, and 38-40 under 35 U.S.C. §103(a) should be withdrawn.

Claims 24, 26-31, 48, 50 and 61 were rejected under 35 U.S.C. §103(a) as being obvious over U.S. Patent No. 3,885,875 to Rosenfeld et al. in view of a combination of U.S. Patent No. 5,812,266 to Hercher, U.S. Patent No. 5,798,829 to Vaez-Iravani, and U.S. Patent No. 5,164,579 to Pryor et al. Independent claims 24 and 48 contain limitations similar to those in claim 1. More specifically, claims 24 and 48 both specify systems for detecting contours on a specimen surface, the system having a multi-element sensing device, the "multi-element sensing device comprising a plurality of linearly oriented sensing elements such that said retro beam is received by at least three of said sensing elements". (Emphasis added.) Accordingly, Applicants respectfully submit that independent claims 24 and 48 distinguishes over the cited references for the same reasons as set forth above with respect to independent claim 1, as amended. Therefore, it is respectfully submitted that the rejection of independent claims 24 and 48 under 35 U.S.C. §103(a) should also be withdrawn.

Claims 26-31 all depend, directly or indirectly, from independent claim 24. Accordingly, Applicants respectfully submit that claims 26-31 all distinguish over the cited references for the same reasons as set forth above with respect to independent claim 24. Claims 50 and 61 both directly depend from independent claim 48. Accordingly, Applicants respectfully submit that claims 50 and 61 distinguish over the cited references for the same reasons as set forth above with respect to independent claim 48. Therefore, it is respectfully submitted that the rejection of claims 26-31, 50 and 61 under 35 U.S.C. §103(a) should also be withdrawn.

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Applicants believe that the foregoing amendments place the application in condition for allowance, and a favorable action is respectfully requested. If for any reason the Examiner finds the application other than in condition for allowance, the Examiner is requested to call the undersigned attorney at the Los Angeles telephone number (213) 488-7100 to discuss the steps necessary for placing the application in condition for allowance should the Examiner believe that such a telephone conference would advance prosecution of the application.

Applicants hereby authorize the Patent Office to charge any deficiencies or credit any overpayment to Deposit Account 16-1805.

Respectfully submitted,

PILLSBURY WINTHROP LLP

Date: May 29, 2001

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**APPENDIX**

**IN THE SPECIFICATION:**

On page 8, line 23, please amend the paragraph beginning with "The optics" as follows:

The optics arrangement 107 includes first lens 111, mask 112, second lens 113, third lens [116] 114, and fourth and fifth lens combination 115, comprising fourth lens 115a and fifth lens 115b. These lenses in the optics arrangement 107 shape and focus the light beams to fix at a desired spot size on the surface of the wafer 110. Dark field collection arrangement 116 is used in conjunction with Dark Field Narrow and Dark Field Wide channels.

**IN THE CLAIMS:**

Please amend claims 1, 24, 37 and 48 as follows:

1. (Thrice amended) A system for inspecting a specimen, comprising:

an optical element arrangement for receiving light from a light generating device and imparting light toward said specimen and receiving a retro beam from said specimen[, said retro beam having a retro beam diameter];

a retro beam diversion element for diverting the retro beam from said optical element arrangement;

a multi-element sensing device for receiving and sensing retro beam position upon diversion from said optical arrangement, said multi-element sensing device comprising a plurality of linearly oriented sensing elements such that said retro beam is received by at least three of said sensing elements; and

a plurality of weighting elements corresponding to each of said plurality of sensing

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elements, wherein each of said weighting elements alters a characteristic of an electrical output of said corresponding sensing element based on a distance of said sensing element from a predetermined point on said multi-element sensing device.

37. (Thrice amended) A method for inspecting a specimen, comprising:  
providing light energy to said specimen via an arrangement of optical elements, thereby creating a retro beam reflected from said specimen;  
passing said retro beam back through said arrangement of optical elements;  
providing said retro beam to a multi-element sensing device, said retro beam having an expected deflection in a substantially predetermined direction and said multi-element sensing device comprising a plurality of linearly oriented sensing elements [components] such that said retro beam is received by at least three of said sensing elements, each of said sensing elements producing an electrical output in response to sensing a portion of said retro beam; and  
altering a characteristic of said electrical output according to a weighting element corresponding to a distance of each of said plurality of sensing elements from a predetermined point on said multi-element sensing device,  
wherein said sensing device senses movement of the retro beam corresponding to anomalies on said specimen.

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